

WHAT IS CLAIMED IS:

1. A high-frequency imaging system, comprising:
 - a high frequency lens configured to form an image of an object at a focal plane, the object emitting electromagnetic radiation at a first frequency above the microwave band of the electromagnetic spectrum;
 - 5 a local oscillator configured to generate an electromagnetic beam at a second frequency, the second frequency being higher than the first frequency; and
 - 10 a plurality of dual-frequency antennas being arrayed to an effective length to receive the electromagnetic radiation at the first frequency, and configured to receive the electromagnetic beam at the second frequency, the dual frequency antennas configured to permit intermodulation of the first and second frequency generating a signal of a third frequency corresponding to the difference between the first and second frequencies, the signal representing the image.
2. The high-frequency imaging system according to claim 1, wherein
15 each dual-frequency antenna comprises:
 - a plurality of dipole antennas; and
 - 15 a plurality of nonlinear resonant circuits, each nonlinear resonant circuit interconnecting at least two of the plurality of dipole antennas and configured to permit re-radiation of signals having the third frequency over the effective length.
- 20 3. The high-frequency imaging system according to claim 2, wherein each of the plurality of dipole antennas comprises a half-wavelength dipole.
4. The high-frequency imaging system according to claim 2, wherein each of the plurality of dipole antennas comprises an electric dipole.
5. The high-frequency imaging system according to claim 2, wherein the
25 nonlinear resonant circuit comprises at least one reactive circuit element.
6. The high-frequency imaging system according to claim 5, wherein the at least one reactive circuit element comprises an inductive circuit element interconnecting at least two of the plurality of dipole antennas.

7. The high-frequency imaging system according to claim 6, wherein the inductive circuit element comprises a looped conductor.

8. The high-frequency imaging system according to claim 5, wherein the at least one reactive circuit element comprises a capacitive circuit element
5 interconnecting at least two of the plurality of dipole antennas.

9. The high-frequency imaging system according to claim 8, wherein the capacitive circuit element comprises a parallel plate capacitor.

10. The high-frequency imaging system according to claim 2, wherein the nonlinear resonant circuit comprises at least one nonlinear circuit element
10 interconnecting at least two of the plurality of dipole antennas.

11. The high-frequency imaging system according to claim 10, wherein the nonlinear circuit element comprises a diode.

12. The high-frequency imaging system according to claim 1, wherein the local oscillator comprises a collimated high-frequency source.

15 13. The high-frequency imaging system according to claim 1, wherein the plurality of dual-frequency antennas are two-dimensionally arrayed.

14. A high-frequency two-dimensional focal plane antenna, comprising:
a plurality of dual-frequency antennas being arrayed to an effective length to receive signals at a first frequency above the microwave band of the electromagnetic
20 spectrum, and configured to receive signals having a second frequency, and, the dual-frequency antennas are configured to permit intermodulation of the first and second frequencies generating a signal of a third frequency corresponding to the difference between the first and second frequencies.

15. The high-frequency two-dimensional focal plane antenna according to
25 claim 14, wherein each dual-frequency antenna comprises:

a plurality of dipole antennas; and
a plurality of nonlinear resonant circuits, each nonlinear resonant circuit interconnecting at least two of the plurality of dipole antennas and configured to permit re-radiation of signals having the third frequency over the effective length.

16. The high-frequency two-dimensional focal plane antenna according to claim 15, wherein each of the plurality of dipole antennas comprises a half-wavelength dipole.

17. The high-frequency two-dimensional focal plane antenna according to 5 claim 15, wherein each of the plurality of dipole antennas comprises an electric dipole.

18. The high-frequency two-dimensional focal plane antenna according to claim 15, wherein the nonlinear resonant circuit comprises at least one reactive circuit element.

10 19. The high-frequency two-dimensional focal plane antenna according to claim 18, wherein the at least one reactive circuit element comprises an inductive circuit element interconnecting at least two of the plurality of dipole antennas.

20. The high-frequency two-dimensional focal plane antenna according to claim 19, wherein the inductive circuit element comprises a looped conductor.

15 21. The high-frequency two-dimensional focal plane antenna according to claim 18, wherein the at least one reactive circuit element comprises a capacitive circuit element interconnecting at least two of the plurality of dipole antennas.

22. The high-frequency two-dimensional focal plane antenna according to claim 21, wherein the capacitive circuit element comprises a parallel plate capacitor.

20 23. The high-frequency two-dimensional focal plane antenna according to claim 15, wherein the nonlinear resonant circuit comprises at least one nonlinear circuit element interconnecting at least two of the plurality of dipole antennas.

24. The high-frequency two-dimensional focal plane antenna according to claim 23, wherein the nonlinear circuit element comprises a diode.

25 25. A method of providing an image of an object emitting electromagnetic radiation at a first frequency above the microwave band of the electromagnetic spectrum, comprising:

focusing the electromagnetic radiation from the object at a focal plane;

transmitting an electromagnetic beam at a second frequency above the microwave band of the electromagnetic spectrum and offset from the first frequency by a difference frequency;

5 receiving the electromagnetic beam and the electromagnetic radiation of the object at a high-frequency antenna comprising a plurality of dual-frequency antennas disposed in the focal plane, each dual-frequency antenna including least two dipole antennas; and

10 converting the first and second frequencies to a signal at the difference frequency through a nonlinear resonant circuit coupling the at least two dipole antennas, thereby providing an image.

26. The method according to claim 25, wherein the step of transmitting further comprises collimating the electromagnetic beam.

27. The method according to claim 25, further comprising, transmitting electromagnetic radiation at the first frequency such that the electromagnetic radiation 15 is reflected by the object to provide the object image.